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Takemoto

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(54) **CIRCUIT BOARD CONNECTING DEVICE**

(56) **References Cited**

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U.S. PATENT DOCUMENTS

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8,647,141 B2 * 2/2014 Lee H01R 13/639
439/372
2004/0248455 A1 * 12/2004 Miller H01R 23/667
439/372
2015/0064942 A1 * 3/2015 Takemoto H01R 12/7029
439/74

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FOREIGN PATENT DOCUMENTS

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JP 2000-260509 A 9/2000
JP 2004-055306 A 2/2004
JP 2013-157188 A 8/2013
JP 2013-218788 A 10/2013
JP 2013-251172 A 12/2013

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* cited by examiner

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Primary Examiner — Gary Paumen

(30) **Foreign Application Priority Data**

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(57) **ABSTRACT**

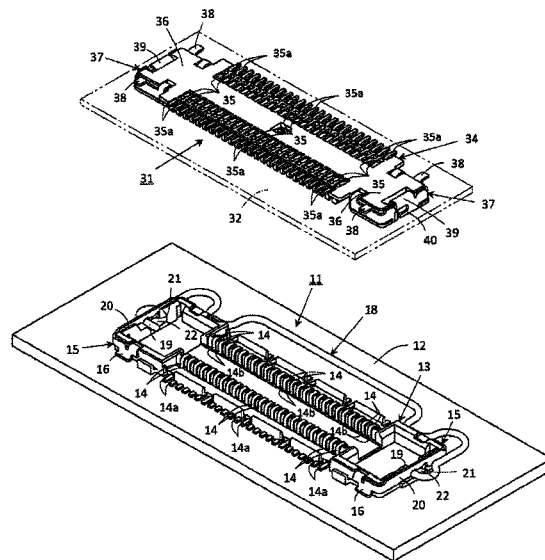
(51) **Int. Cl.**
H01R 12/71 (2011.01)
H01R 13/514 (2006.01)
H01R 13/627 (2006.01)
H01R 13/639 (2006.01)
H01R 13/20 (2006.01)
H01R 12/73 (2011.01)

A circuit board connecting device comprising a first connector which having a first fixing metallic member attached to a first housing, a second connector having a second fixing metallic member attached to a second housing, and holding means operative to prevent the second housing from being undesirably separated from the first housing under a condition in which the first and second housings are coupled with each other, wherein end portions of a resilient movable holding member provided on the first connector to be movable in a predetermined direction are supported respectively by the first fixing metallic member to engage respectively with portions of the second fixing metallic member for holding the second housing when the second housing is coupled with the first housing, so that the end portions of the resilient movable holding member and the portions of the second fixing metallic member constitute the holding means.

(52) **U.S. Cl.**
CPC **H01R 12/716** (2013.01); **H01R 13/514** (2013.01); **H01R 13/627** (2013.01); **H01R 13/639** (2013.01); **H01R 12/73** (2013.01); **H01R 13/20** (2013.01)

(58) **Field of Classification Search**
CPC H01R 13/62933; H01R 23/725; H01R 13/639; H01R 9/096
See application file for complete search history.

9 Claims, 15 Drawing Sheets



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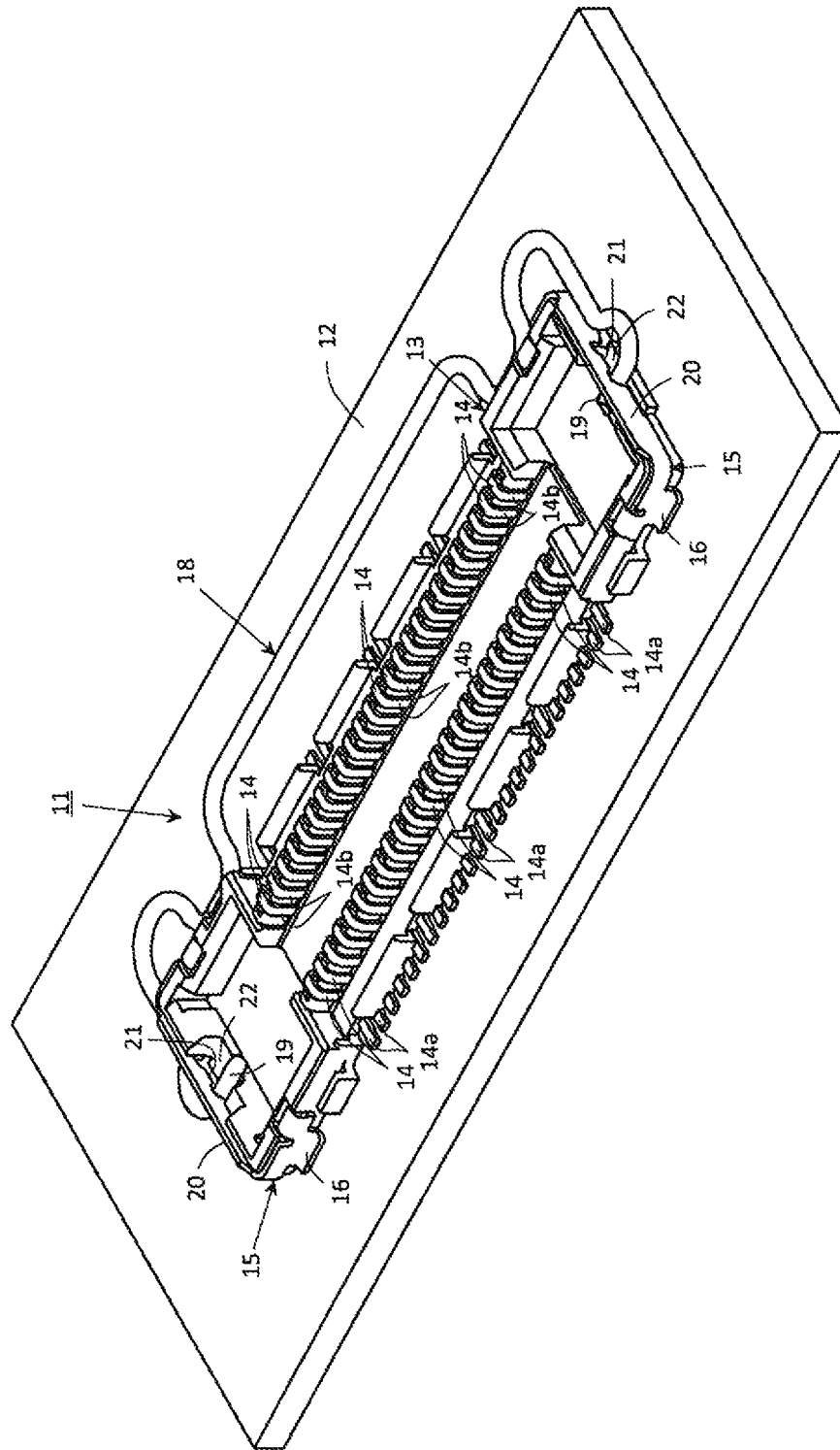


FIG. 2

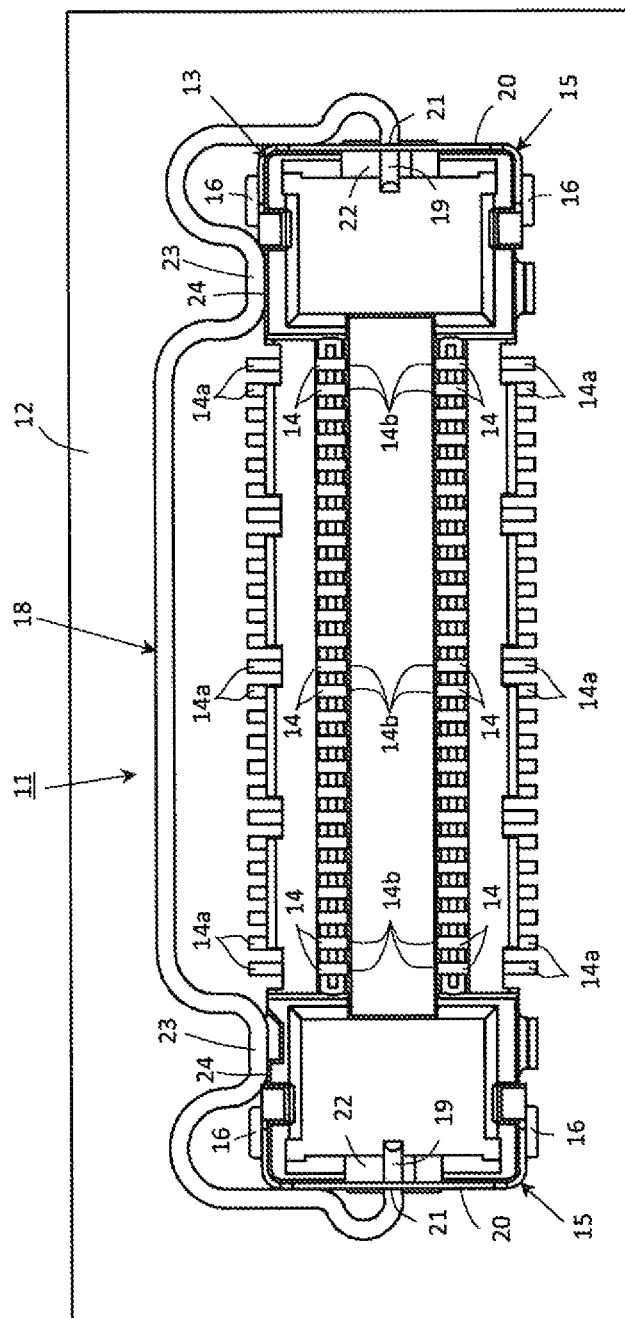


FIG. 3

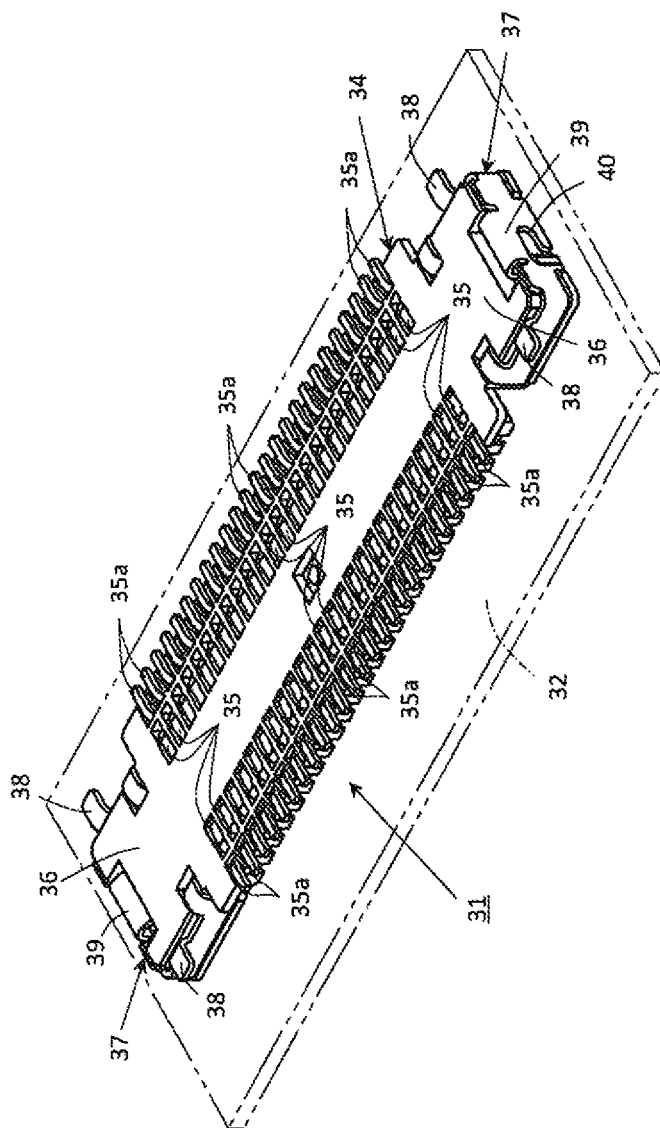


FIG. 4

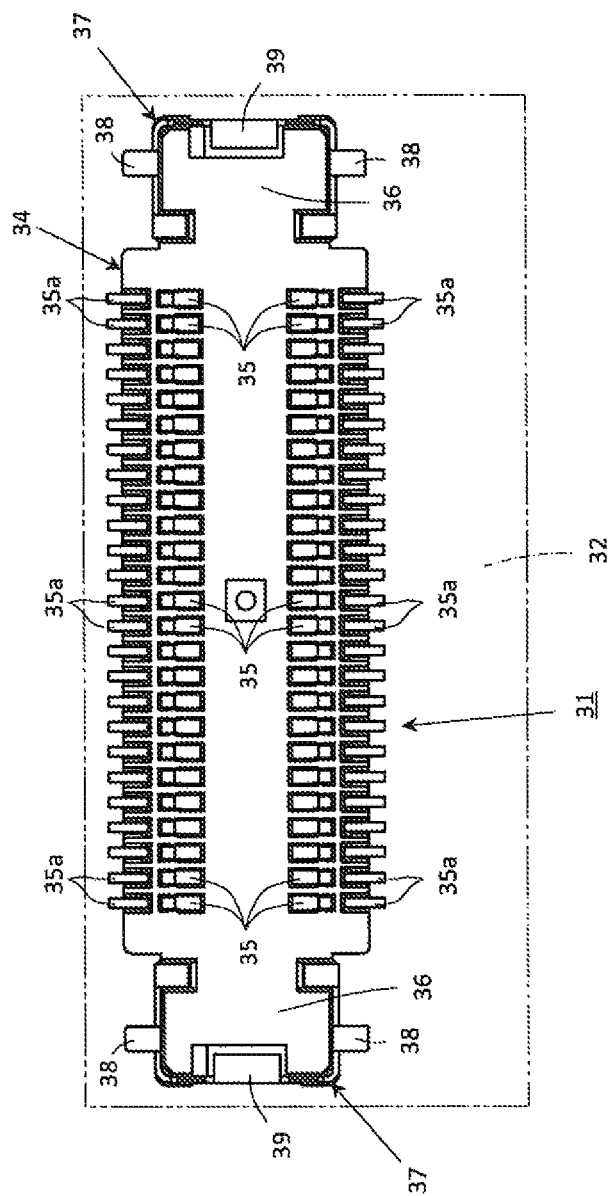


FIG. 5

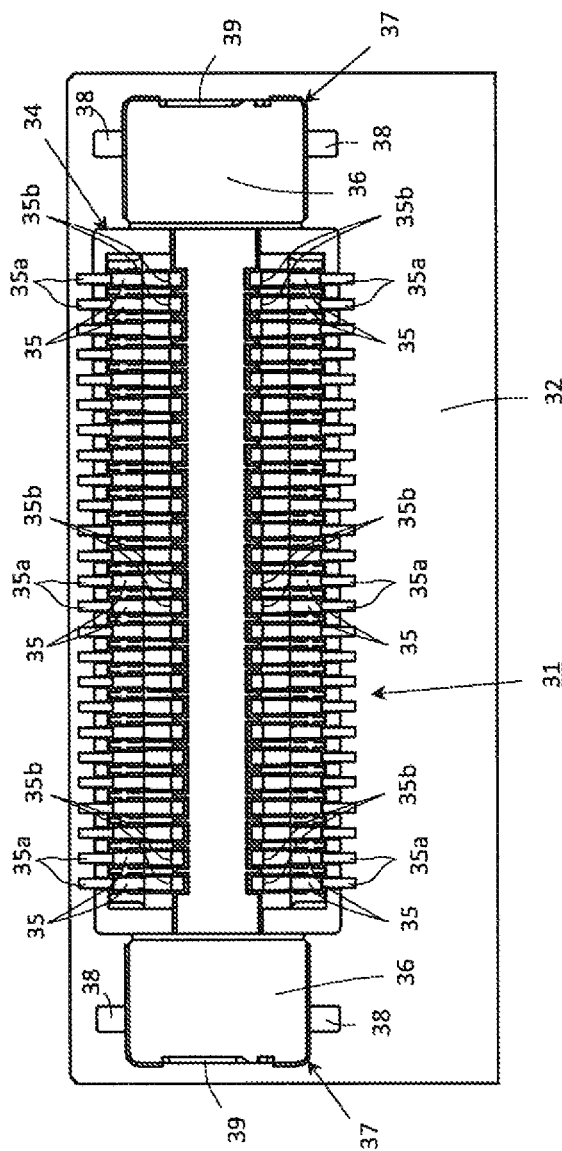


FIG. 6

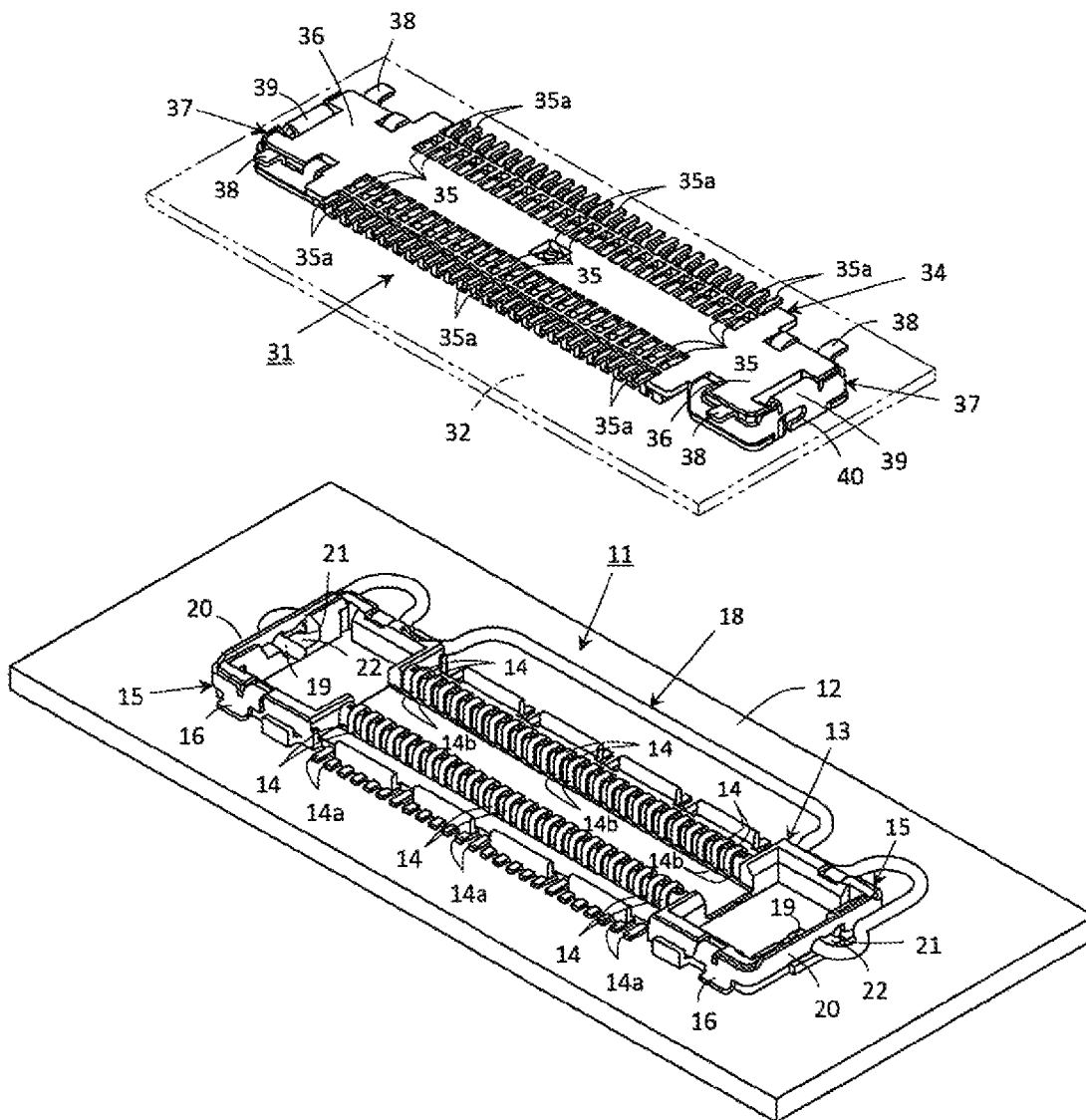
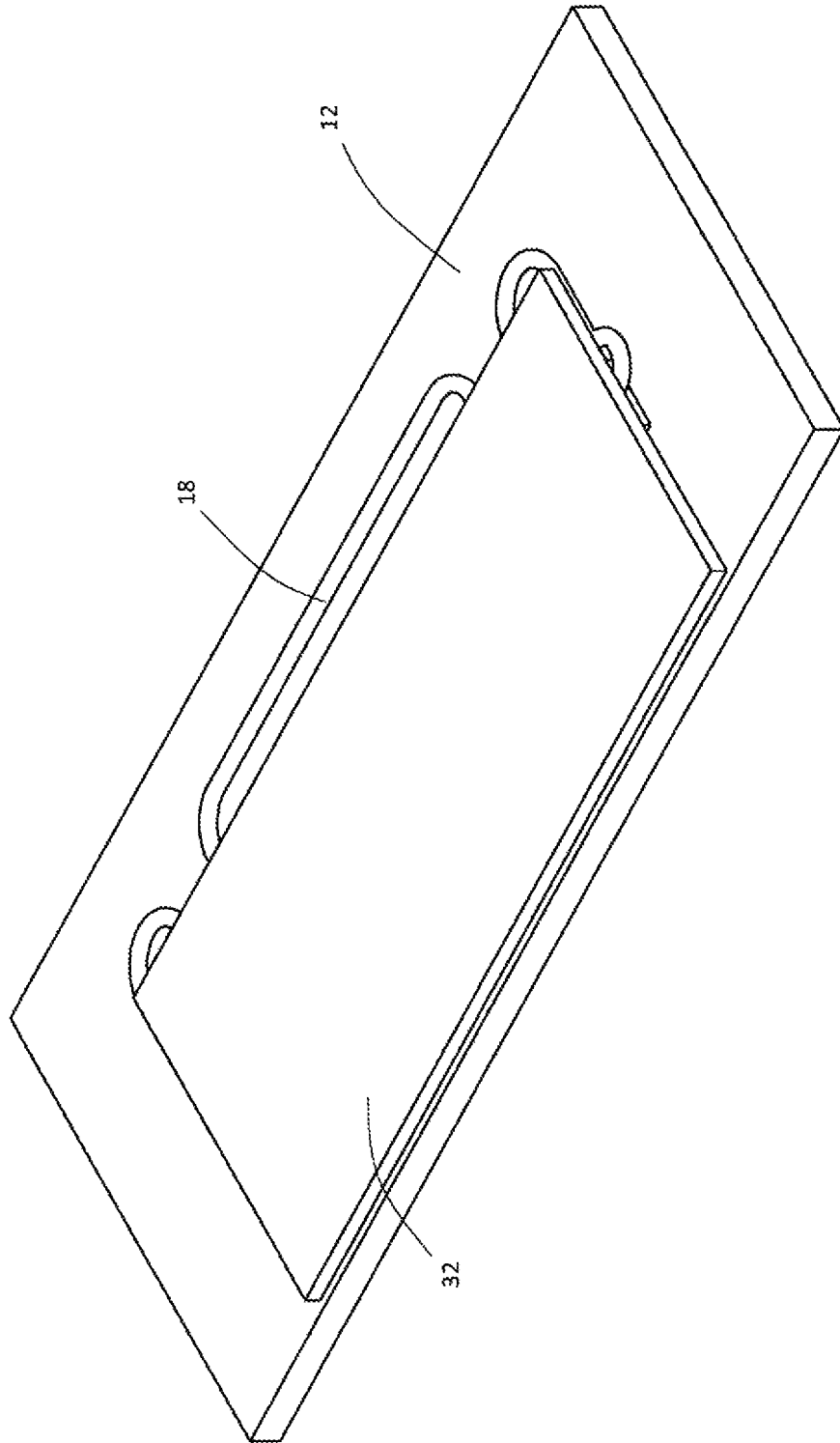


FIG. 7



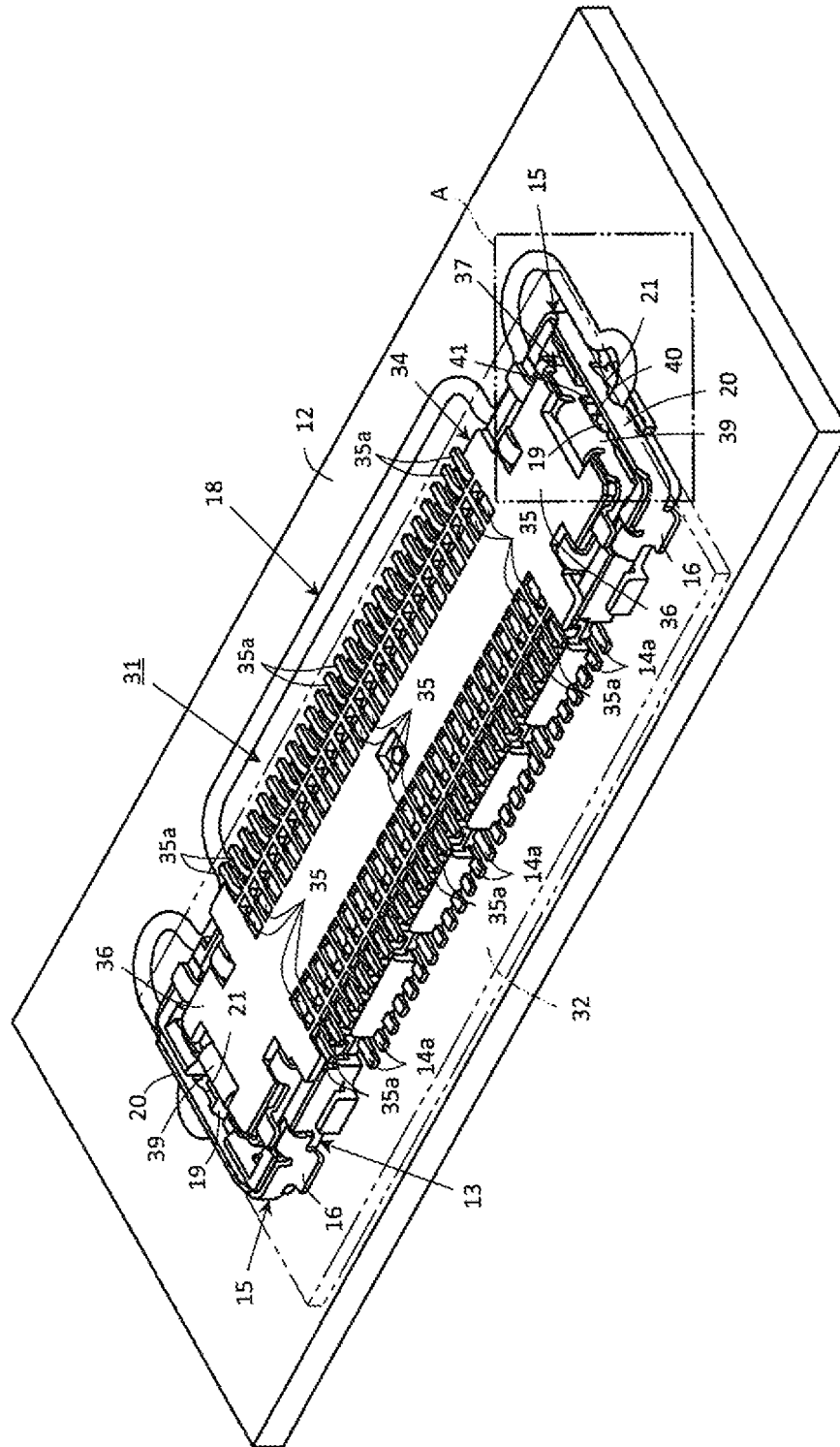
FIG^x 8

FIG. 9

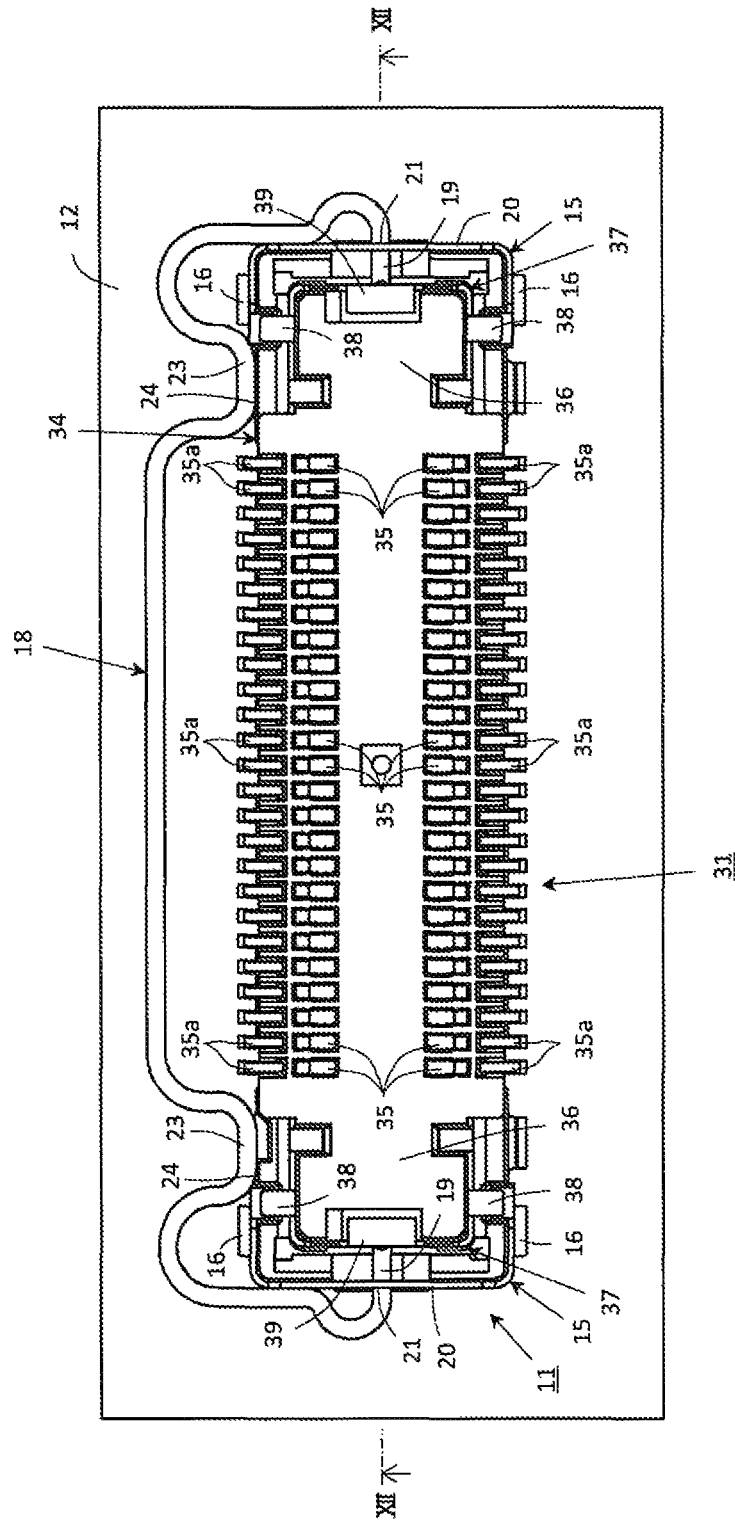


FIG. 10

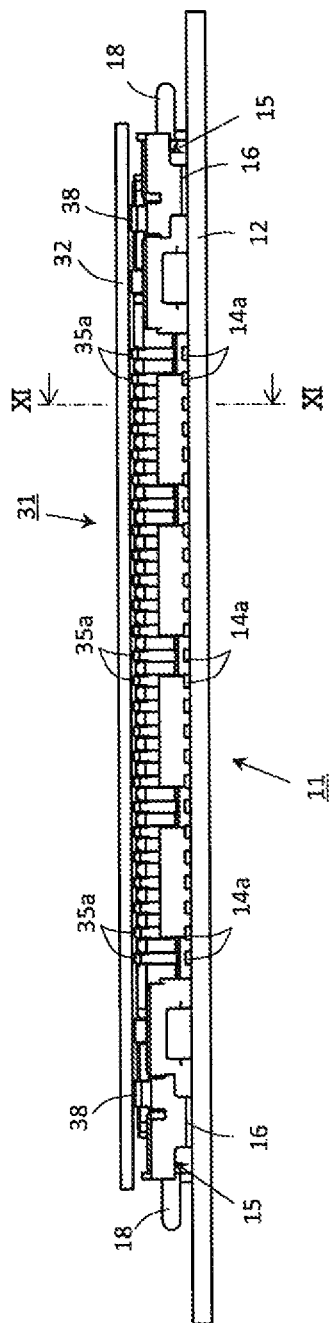


FIG. 11

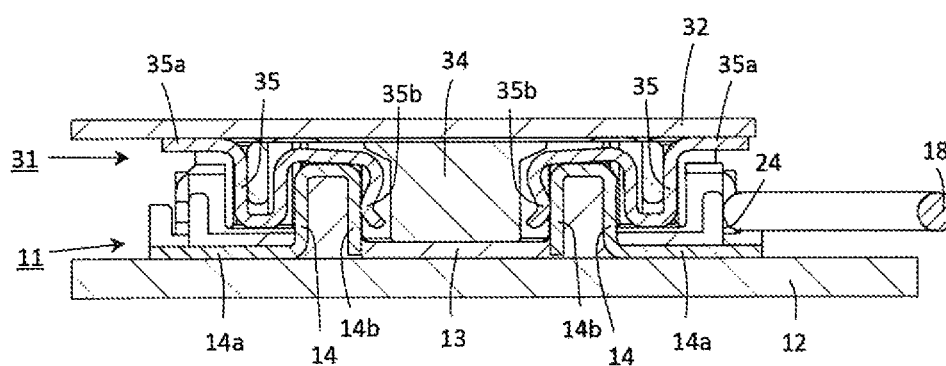


FIG. 12

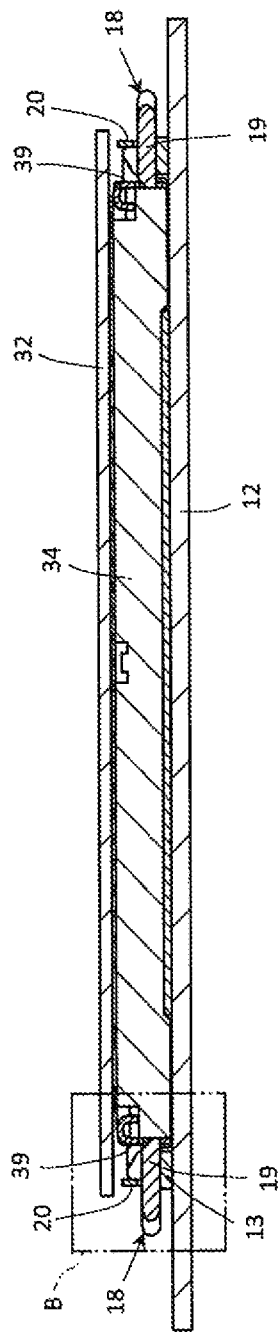


FIG. 13

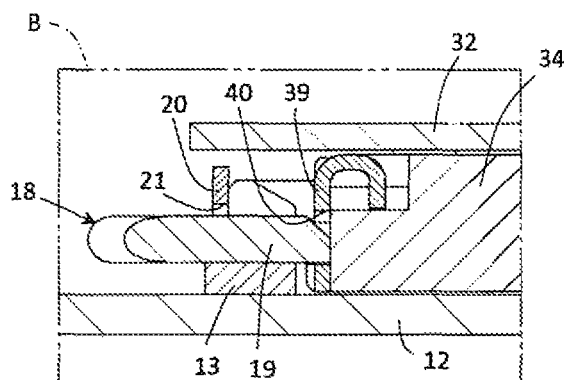


FIG. 14

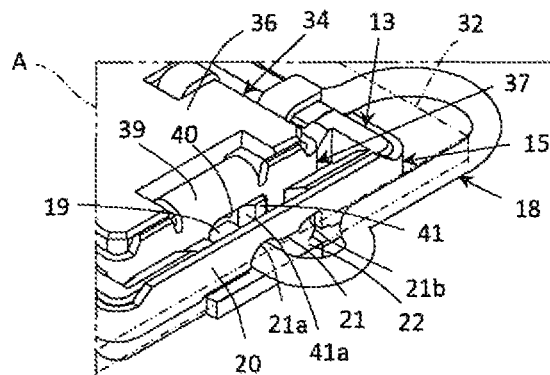


FIG. 15

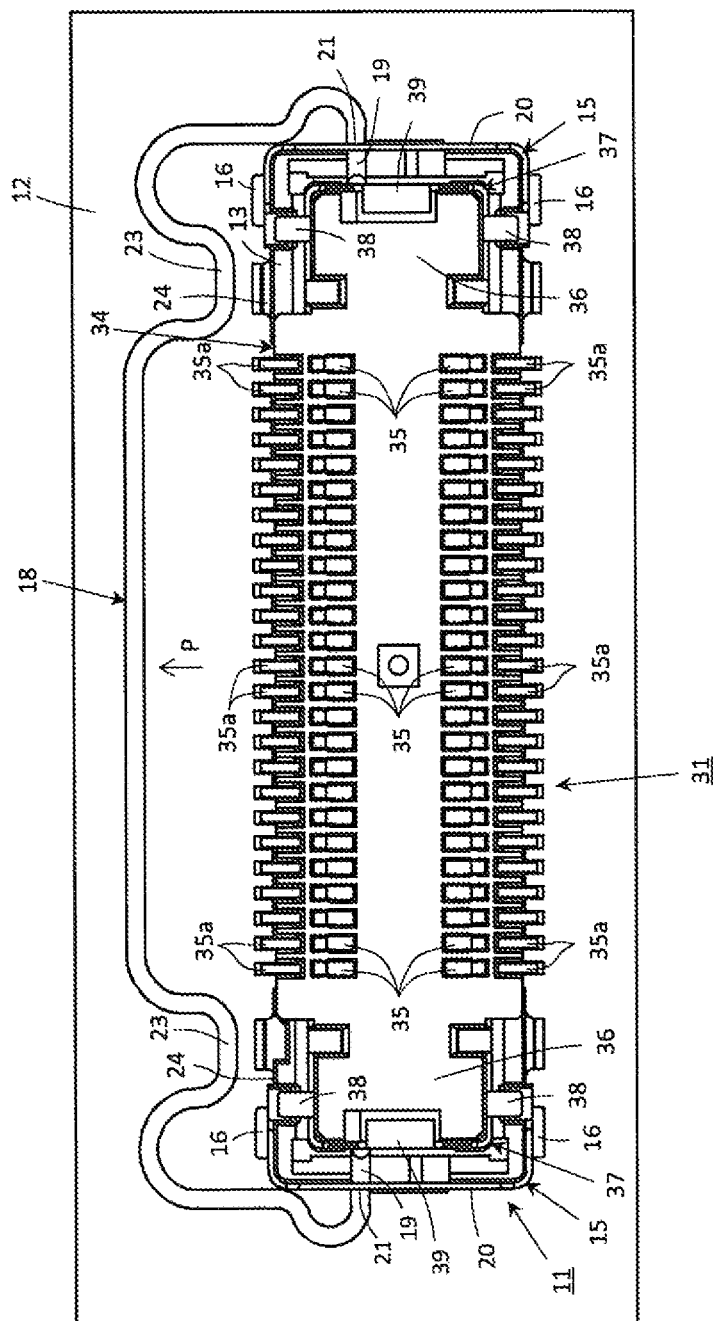


FIG. 16

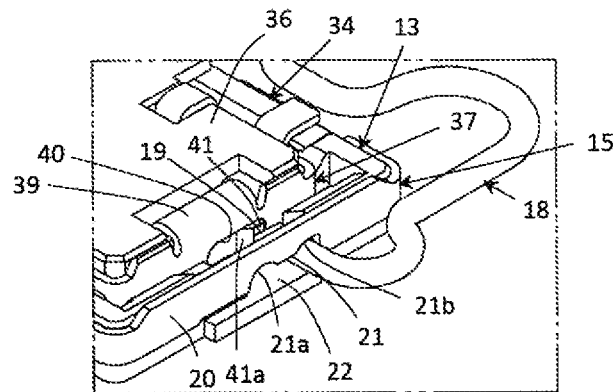
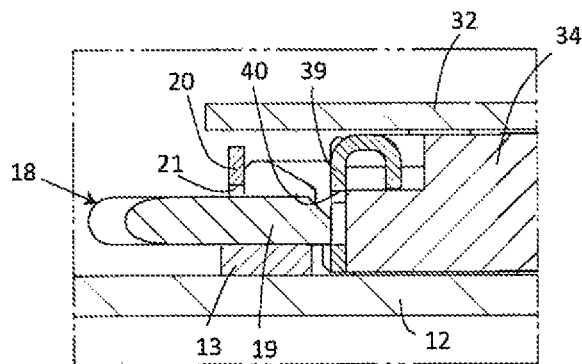


FIG. 17



CIRCUIT BOARD CONNECTING DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to a circuit board connecting device, and more particularly to an improvement in a circuit board connecting device which is used for putting first and second groups of circuit terminals provided respectively on a couple of separate circuit boards in mutual electrical connection so that the separate circuit boards are electrically connected with each other under a condition wherein one of the separate circuit boards is closely laid on top of the other of the separate circuit boards.

2. Description of the Prior Art Including Information Disclosed Under 37 CFR 1.97 and 37 CFR 1.98

Various kinds of electric or electronic parts are built even in a relatively small-sized electronic apparatus such as a mobile phone or the like. A major part of those parts are dispersedly mounted on, for example, a couple of separate circuit boards to fulfill their respective functions. In the relatively small-sized electronic apparatus, having an eye to the couple of separate circuit boards on which the electric or electronic parts are mounted, it is likely that one of the separate circuit boards is required to be closely laid on top of the other of the separate circuit boards for reducing a space occupied thereby when the separate circuit boards are electrically connected with each other. Such electrical connection between the separate circuit boards wherein one is closely laid on top of the other is hereinafter referred to as electrical piled-up connection.

In general, when a plurality of circuit boards, such as solid circuit boards or flexible printed circuit boards (FPCs), are electrically connected with one another, a plurality of electrical connectors are mounted on the circuit boards, respectively, and one of the electrical connectors is engaged with another electrical connector so as to connect one of the circuit boards electrically with another circuit board. In case of the electrical piled-up connection mentioned above, first and second electrical connectors are mounted respectively on the separate circuit boards to be engaged with each other. The first electrical connector is formed into a plug type connector and the second electrical connector is formed into a receptacle type connector to be a mate electrical connector for the first electrical connector, so that the plug type connector is engaged with the receptacle type connector when the separate circuit boards are put in a condition of the electrical piled-up connection.

Under such a situation, there have been previously proposed several circuit board connecting devices, each of which is used for putting a couple of circuit boards in the electrical piled-up connection, as disclosed in, for example, the Japanese patent application published before examination under publication number 2000-260509 (hereinafter, referred to as published prior art document 1) and the Japanese patent application published before examination under publication number 2004-55306 (hereinafter, referred to as published prior art document 2).

A circuit board connecting device (a board-to-board connecting system) disclosed in the published prior art document 1 comprises a first connector (a connector piece (100)) mounted on a surface of a first circuit board (a board (110)) so as to be fixed to the first circuit board and a second connector (a connector piece (200)) mounted on a surface of a second circuit board (a board (210)) so as to be fixed to the second circuit board, wherein the first and second circuit boards are to be subjected to the electrical pile-up connection. The first

connector is provided with a plurality of first contacts (contacts (120)) arranged on a housing (130) and the second connector is provided with a plurality of second contacts (contacts (220)) arranged on a housing (230). Each of the first contacts has a top end portion thereof folded back in the shape of U to be resiliently transformed.

When the surface of the first circuit board on which the first connector is mounted is caused to be opposite to the surface of the second circuit board on which the second connector is mounted so that the first circuit board is closely laid on top of the second circuit board, the first and second connectors are coupled with each other and the top end portion of each of the first contacts of the first connector comes into contact with a corresponding one of the second contacts of the second connector. Thereby, the first contacts of the first connector are connected respectively with the second contacts of the second connector and the first and second circuit boards are put in a condition of the electrical piled-up connection.

With the first and second circuit boards thus put in the condition of the electrical piled-up connection, since the top end portion of each of the first contacts of the first connector, which is folded back in the shape of U to be resiliently transformed, is put in press-contact with the corresponding one of the second contacts of the second connector with resilient transformations thereof, it is expected that the first and second contacts are surely connected with each other.

Then, a circuit board connecting device (a board connecting connector) disclosed in the published prior art document 2 comprises a first connector (a plug connector (24)) mounted on a surface of a first circuit board (a printed circuit board (26)) so as to be fixed to the first circuit board and a second connector (a receptacle connector (20)) mounted on a surface of a second circuit board (a printed circuit board (22)) so as to be fixed to the second circuit board, wherein the first and second circuit boards are to be subjected to the electrical pile-up connection. The first connector is provided with a plurality of first contacts (contact terminals (28Ai), (28Bi)) arranged on a first housing (a base portion (24M)) and the second connector is provided with a plurality of second contacts (contact terminals (34Ai), (34Bi)) arranged on a second housing (a base portion (20M)). An engaging hook (30N) is formed on a coupling portion (30m) of a supporting member (30) pressed in the first housing of the first connector and a projection (32mr) is formed on a resilient tongue portion (32mr) of a supporting member (32) pressed in the second housing of the second connector.

When the surface of the first circuit board on which the first connector is mounted is caused to be opposite to the surface of the second circuit board on which the second connector is mounted so that the first circuit board is closely laid on top of the second circuit board, the first and second connectors are coupled with each other and each of the first contacts of the first connector comes into contact with a corresponding one of the second contacts of the second connector. Thereby, the first contacts of the first connector are connected respectively with the second contacts of the second connector and the first and second circuit boards are put in a condition of the electrical piled-up connection.

With the first and second circuit boards thus put in the condition of the electrical piled-up connection, the engaging hook (30N) formed on the coupling portion (30m) of the supporting member (30) pressed in the first housing of the first connector is put in engagement with the projection (32mr) formed on the resilient tongue portion (32mr) of the supporting member (32) pressed in the second housing of the second connector so as to prevent the first housing of the first connector from being separated from the second housing of

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the second connector. Thereby, the first contacts of the first connector and the second contacts of the second connector are stably connected with each other and consequently it is expected that the electrical piled-up connection between the first and second circuit boards is stably maintained.

In each of the previously proposed circuit board connecting devices used for putting a couple of circuit boards in the electrical piled-up connection as described above, there are the following defects or disadvantages.

In the case of the circuit board connecting device disclosed in the published prior art document 1, any locking means or holding means for preventing the first housing of the first connector from being separated from the second housing of the second connector under a condition wherein the first and second connector are coupled with each other is not provided. Accordingly, when undesirable external force acts on one or both of the first and second connectors coupled with each other, for example, the first contacts of the first connector and the second contacts of the second connector are put in unstable mutual connection and consequently it is feared that the electrical piled-up connection between the first and second circuit boards is not stably maintained.

Further, in the case of the circuit board connecting device disclosed in the published prior art document 2, the engaging hook (30N) which is formed on the coupling portion (30m) of the supporting member (30) pressed in the first housing of the first connector and the projection (32mn) which is formed on the resilient tongue portion (32mr) of the supporting member (32) pressed in the second housing of the second connector and with which the engaging hook (30N) engages, are so provided as to be locking means or holding means for preventing the first housing of the first connector from being separated from the second housing of the second connector under a condition wherein the first and second connector are coupled with each other. However, the engaging hook (30N) cannot be operative to engage firmly with the projection (32mn) because of structural limitations in each of the coupling portion (30m) of the supporting member (30) on which the engaging hook (30N) is formed and the resilient tongue portion (32mr) of the supporting member (32) on which the projection (32mn) is formed. Accordingly, when undesirable external force acts on one or both of the first and second connectors coupled with each other, for example, the engaging hook (30N) disengages easily from the projection (32mn), so that the first contacts of the first connector and the second contacts of the second connector are put in unstable mutual connection and consequently it is feared that the electrical piled-up connection between the first and second circuit boards is not stably maintained.

BRIEF SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a circuit board connecting device for putting a couple of circuit boards in electrical piled-up connection, which includes a first connector having a first insulating housing fixed to a first circuit board, a second connector having a second insulating housing fixed to a second circuit board, and holding means operative to prevent the second insulating housing of the second connector from being undesirably separated from the first insulating housing of the first connector under a condition wherein the first and second insulating housings are coupled with each other, and which avoids the aforementioned problems and disadvantages encountered with the prior art.

Another object of the present invention is to provide a circuit board connecting device for putting a couple of circuit

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boards in electrical piled-up connection, which includes a first connector having a first insulating housing fixed to a first circuit board, a second connector having a second insulating housing fixed to a second circuit board, and holding means operative to prevent the second insulating housing of the second connector from being undesirably separated from the first insulating housing of the first connector under a condition wherein the first and second insulating housings are coupled with each other, and with which the mutual coupling between the first and second insulating housings is maintained stably and firmly by the holding means.

A further object of the present invention is to provide a circuit board connecting device for putting a couple of circuit boards in electrical piled-up connection, which includes a first connector having a first insulating housing fixed to a first circuit board, a second connector having a second insulating housing fixed to a second circuit board, and holding means operative to prevent the second insulating housing of the second connector from being undesirably separated from the first insulating housing of the first connector under a condition wherein the first and second insulating housings are coupled with each other, and with which the second insulating housing can be smoothly separated intentionally from the first insulating housing by quite simple and easy operations under the condition wherein the first and second insulating housings are coupled with each other.

A still further object of the present invention is to provide a circuit board connecting device for putting a couple of circuit boards in electrical piled-up connection, which includes a first connector having a first insulating housing fixed to a first circuit board, a second connector having a second insulating housing fixed to a second circuit board, and holding means operative to prevent the second insulating housing of the second connector from being undesirably separated from the first insulating housing of the first connector under a condition wherein the first and second insulating housings are coupled with each other, and with which a thickness of the device in a direction perpendicular to each of surfaces of the first and second circuit boards facing each other can be effectively reduced under a condition wherein the first and second circuit board are put in the electrical piled-up connection.

According to the present invention, there is provided a circuit board connecting device for putting a couple of circuit boards in electrical piled-up connection, which comprises a first connector which has a first insulating housing, a plurality of first contacts arranged on the first insulating housing, each of which is provided with a board connecting portion to be connected with a circuit terminal provided on a first circuit board, and a first fixing metallic member attached to the first insulating housing for fixing the first insulating housing to the first circuit board; a second connector which has a second insulating housing operative to be coupled with the first insulating housing, a plurality of second contacts arranged on the second insulating housing, each of which is provided with a board connecting portion to be connected with a circuit terminal provided on a second circuit board and is operative to come into contact with a corresponding one of the first contacts, and a second fixing metallic member attached to the second insulating housing for fixing the second insulating housing to the second circuit board; and holding means operative to hold the second insulating housing for preventing the same from being undesirably separated from the first insulating housing under a condition wherein the first and second insulating housings are coupled with each other, wherein a resilient movable holding member is provided on the first connector to elongate along a longitudinal direction

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of the first insulating housing with a pair of end portions thereof supported respectively by a couple of portions of the first fixing metallic member positioned respectively at a pair of end portions of the first insulating housing in its longitudinal direction and to be movable in a direction perpendicular to the longitudinal direction of the first insulating housing; a pair of engaging portions are formed respectively on a couple of portions of the second fixing metallic member positioned respectively at a pair of end portions of the second insulating housing in its longitudinal direction; the end portions of the resilient movable holding member supported by the first fixing metallic member are caused to engage respectively with the engaging portions formed on the second fixing metallic member for holding the second insulating housing when the second insulating housing is coupled with the first insulating housing, so that the end portions of the resilient movable holding member supported by the first fixing metallic member and the engaging portions formed on the second fixing metallic member constitute the holding means; and the end portions of the resilient movable holding member supported by the first fixing metallic member are caused to disengage respectively from the engaging portions formed on the second fixing metallic member for releasing the second insulating housing from holding by the holding means when the resilient movable holding member is moved in the direction perpendicular to the longitudinal direction of the first insulating housing under a condition wherein the second insulating housing is held by the holding means.

In the circuit board connecting device thus constituted in accordance with the present invention, when the second circuit board is closely laid on top of the first circuit board under a condition wherein a surface of the second circuit board on which the second insulating housing of the second connector is mounted to be fixed to the second circuit board is opposite to a surface of the first circuit board on which the first insulating housing of the first connector is mounted to be fixed to the first circuit board, the second insulating housing is coupled with the first insulating housing so that the second contacts arranged on the second insulating housing come into contact respectively with the first contacts arranged on the first insulating housing. Thereby, the first and second connectors are put in mutual engagement and the circuit terminals provided on the second circuit board are electrically connected through the first and second contacts with the first circuit terminals provided on the first circuit board, so that the first and second circuit board are put in electrical piled-up connection to be electrically connected with each other.

Under such a condition, the end portions of the resilient movable holding member provided on the first connector to elongate along the longitudinal direction of the first insulating housing and to be movable in the direction perpendicular to the longitudinal direction of the first insulating housing, which are supported respectively by the portions of the first fixing metallic member positioned respectively at the end portions of the first insulating housing in its longitudinal direction, are caused to engage respectively with the engaging portions formed on the portions of the second fixing metallic member positioned respectively at the end portions of the second insulating housing in its longitudinal direction so as to hold the second insulating housing. Such a condition of engagement wherein each of the end portions of the resilient movable holding member supported by the first fixing metallic member engages with the engaging portion formed on the second fixing metallic member is maintained without being broken with resiliency of the resilient movable holding member and thereby each of the end portions of the resilient movable holding member is put in stable engagement with the

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engaging portion. Accordingly, the end portions of the resilient movable holding member and the engaging portions formed on the second fixing metallic member constitute the holding means which is operative to prevent the second insulating housing from being separated from the first insulating housing under the condition wherein the first and second insulating housings are coupled with each other.

Each of the portions of the first fixing metallic member operative to support respectively the end portions of the resilient movable holding member is provided with, for example, a supporting slit through which the end portion of the resilient movable holding member passes to be supported thereby so as to be movable along the supporting slit in the direction perpendicular to the longitudinal direction of the first insulating housing.

Then, when the resilient movable holding member is moved in the direction perpendicular to the longitudinal direction of the first insulating housing under the condition wherein the end portions of the resilient movable holding member are put in engagement respectively with the engaging portions formed on the second fixing metallic member to hold the second insulating housing, the condition of engagement wherein each of the end portions of the resilient movable holding member engages with the engaging portions formed on the second fixing metallic member is broken. As a result, the second insulating housing of the second connector is able to be intentionally separated from the first insulating housing of the first connector.

The resilient movable holding member is, for example, made of resilient bent rod member and each of the end portions of the resilient movable holding member supported respectively by the supporting slits provided on the first fixing metallic member is resiliently movable in regard to the first fixing metallic member.

A cam portion is provided on each of the end portions of the second resilient housing in its longitudinal direction or each of the portions of the second fixing metallic member, for example. Each of the cam portions thus provided is operative to come into contact with the end portion of the resilient movable holding member to move the same resiliently in regard to the first fixing metallic member so that the end portion of the resilient movable holding member disengages from the engaging portion formed on the portion of the second fixing metallic member when the resilient movable holding member is moved in the direction perpendicular to the longitudinal direction of the first insulating housing under the condition wherein the end portions of the resilient movable holding member are put in engagement respectively with the engaging portions to hold the second fixing metallic member.

Further, each of the engaging portions formed on the second fixing metallic member is constituted, for example, in the shape of a cut-out or slit with which the end portion of the resilient movable holding member supported by the first fixing metallic member engages.

With the circuit board connecting device according to the present invention, when the second insulating housing of the second connector is coupled with the first insulating housing of the first connector in such a manner that the longitudinal direction of the second insulating housing is in parallel with the longitudinal direction of the first insulating housing and the second contacts arranged on the second insulating housing are put in contact respectively with the first contacts arranged on the first insulating housing, the end portions of the resilient movable holding member provided on the first connector are caused to hold the second insulating housing and thereby the second insulating housing is prevented from being undesirably separated from the first insulating housing.

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Then, when the resilient movable holding member is moved in the direction perpendicular to the longitudinal direction of the first insulating housing under the condition wherein the second insulating housing is held by the end portions of the resilient movable holding member, the end portions of the resilient movable holding member are operative to release the second insulating housing to be free, so that the second insulating housing of the second connector is able to be intentionally separated from the first insulating housing of the first connector.

The resilient movable holding member provided on the first connector elongates along the longitudinal direction of the first insulating housing with the end portions thereof supported respectively by the portions of the first fixing metallic member positioned respectively at the end portions of the first insulating housing in its longitudinal direction to be movable in the direction perpendicular to the longitudinal direction of the first insulating housing. The end portions of the resilient movable holding member supported respectively by the portions of the first fixing metallic members are caused to engage respectively with the engaging portions formed on the portions of the second fixing metallic member positioned respectively at the end portions of the second insulating housing in its longitudinal direction for holding the second insulating housing when the second insulating housing is coupled with the first insulating housing. The condition of engagement wherein each of the end portions of the resilient movable holding member engages with the engaging portion formed on the second fixing metallic member is maintained with resiliency of the resilient movable holding member and thereby the second insulating housing is put in a stable holding by the end portions of the resilient movable holding member.

Then, when the resilient movable holding member is moved in the direction perpendicular to the longitudinal direction of the first insulating housing under the condition wherein the end portions of the resilient movable holding member are put in engagement with the engaging portions formed on the second fixing metallic member, each of the end portions of the resilient movable holding member is caused to disengage from the engaging portion formed on the second fixing metallic member. As a result, the second insulating housing is released from the holding by the end portions of the resilient movable holding member.

Accordingly, with the end portions of the resilient movable holding member provided on the first connector and the engaging portions formed on the second fixing metallic member attached to the second insulating housing of the second connector, which constitute the holding means, the mutual coupling between the first insulating housing of the first connector and the second insulating housing of the second connector is stably and firmly maintained, and then the second insulating housing can be smoothly separated intentionally from the first insulating housing by quite simple and easy operations to move the resilient movable holding member in the direction perpendicular to the longitudinal direction of the first insulating housing.

Further, with the resilient movable holding member provided on the first connector to elongate along the longitudinal direction of the first insulating housing and to have the end portions thereof supported respectively by the portions of the first fixing metallic member positioned respectively at the end portions of the first insulating housing in its longitudinal direction to be movable in the direction perpendicular to the longitudinal direction of the first insulating housing, a thickness of the device including the first and second connectors put between the first and second circuit boards in a direction

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perpendicular to each of the surfaces of the first and second circuit boards facing each other, on one of which the first insulating housing is mounted and the other of which the second insulating housing is mounted, can be effectively reduced under the condition wherein the first and second circuit board are put in the electrical piled-up connection.

The above, and other objects, features and advantages of the present invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. 1 is a schematic perspective view showing a plug connector included in an embodiment of circuit board connecting device according to the present invention, together with a first circuit board on which an insulating housing of the plug connector is fixed;

FIG. 2 is a schematic plan view showing the plug connector and the first circuit board;

FIG. 3 is a schematic perspective view showing a receptacle connector included in the embodiment of circuit board connecting device according to the present invention, together with a second circuit board on which an insulating housing of the receptacle connector is fixed and which is shown by imaginary lines;

FIG. 4 is a schematic plan view showing the receptacle connector and the second circuit board shown by imaginary lines;

FIG. 5 is a schematic bottom view showing the receptacle connector and the second circuit board;

FIG. 6 is a schematic perspective view showing the plug connector accompanied with the first circuit board and the receptacle connector accompanied with the second circuit board shown by imaginary lines and placed to be opposite to the plug connector;

FIG. 7 is a schematic perspective view showing a condition wherein the receptacle connector accompanied with the second circuit board is engaged with the plug connector accompanied with the first circuit board;

FIG. 8 is a schematic perspective view showing a condition wherein the receptacle connector accompanied with the second circuit board shown by imaginary lines is engaged with the plug connector accompanied with the first circuit board;

FIG. 9 is a schematic plan view showing a condition wherein the receptacle connector is engaged with the plug connector accompanied with the first circuit board and the second circuit board is eliminated for convenience' sake;

FIG. 10 is a schematic front view showing the condition wherein the receptacle connector accompanied with the second circuit board is engaged with the plug connector accompanied with the first circuit board;

FIG. 11 is a schematic cross-sectional view taken along line XI-XI in FIG. 10;

FIG. 12 is a schematic cross-sectional view taken along line XII-XII in FIG. 9;

FIG. 13 is a schematic enlarged partial cross-sectional view showing an inside of a tow-dot chain line frame B in FIG. 12;

FIG. 14 is a schematic enlarged partial perspective view showing an inside of a tow-dot chain line frame A in FIG. 8;

FIG. 15 is a schematic plan view used for explaining a positional relationship between end portions of a resilient movable metallic member of the plug connector and engaging portions of the receptacle connector under the condition wherein the receptacle connector is engaged with the plug

connector accompanied with the first circuit board and the second circuit board is eliminated for convenience' sake;

FIG. 16 is a schematic partial perspective view used for explaining a positional relationship between the end portions of the resilient movable metallic member of the plug connector and the engaging portions of the receptacle connector under the condition wherein the receptacle connector is engaged with the plug connector accompanied with the first circuit board and the second circuit board is eliminated for convenience' sake; and

FIG. 17 is a schematic partial cross-sectional view used for explaining the positional relationship between the end portions of the resilient movable metallic member of the plug connector and the engaging portions of the receptacle connector under the condition wherein the receptacle connector accompanied with the second circuit board is engaged with the plug connector accompanied with the first circuit board.

DETAILED DESCRIPTION OF THE INVENTION

Each of FIGS. 1 and 2 shows a plug connector 11 which constitutes a first connector included in an embodiment of circuit board connecting device according to the present invention and a first circuit board 12 on which the plug connector 11 is provided. The plug connector 11 has an insulating housing 13 made of insulator such as plastics or the like to constitute a first insulating housing. The insulating housing 13 is mounted on a surface of the first circuit board 12 facing upward in FIG. 1 (hereinafter, referred to an upper surface of the first circuit board 12) to be fixed to the first circuit board 12.

A plurality of first contacts 14 are arranged on the insulating housing 13 in a longitudinal direction of the same to make a couple of parallel lines each elongating along the longitudinal direction of the insulating housing 13. Each of the first contacts 14 is made of resilient conductive plate material to be shaped into a bent stripe and provided, respectively at both end portions of the bent stripe, with a board connecting portion 14a to be connected with a circuit terminal provided on the upper surface of the first circuit board 12 and a contact-connecting portion 14b operative to come into contact with a second contact provided in a receptacle connector constituting a second connector included in the embodiment of circuit board connecting device according to the present invention, as described later.

Further, a first fixing metallic member 15 is attached to the insulating housing 13 for surrounding the same along the upper surface of the first circuit board 12 so as to cover partially the outer surface of the insulating housing 13. A plurality of board joining portions 16 are provided on the first fixing metallic member 15 to be joined to the upper surface of the first circuit board 12. The first fixing metallic member 15 is operative to fix the insulating housing 13 to the first circuit board 12 when the board joining portions 16 are joined to the upper surface of the first circuit board 12.

The plug connector 11 having the insulating housing 13, the first contacts 14 and the first fixing metallic member 15 is further provided thereon with a resilient movable holding member 18 elongating in a direction along which the first contacts 14 are arranged, that is, the longitudinal direction of the insulating housing 13. A pair of end portions 19 of the resilient movable holding member 18 are supported respectively by a couple of side end portions 20 of the first fixing metallic member 15 positioned respectively at end portions of the insulating housing 13 in its longitudinal direction. The resilient movable holding member 18 is formed by bending a resilient metallic rod or the like and each of the end portions

19 of the resilient movable holding member 18 supported respectively by the side end portions 20 of the first fixing metallic member 15 is movable resiliently in regard to the side end portion 20 of the first fixing metallic member 15 in the longitudinal direction of the insulating housing 13.

Each of the side end portions 20 of the first fixing metallic member 15 is provided thereon with a supporting slit 21 through which the end portion 19 of the resilient movable holding member 18 passes in the longitudinal direction of the insulating housing 13 from the outside to the inside of the first fixing metallic member 15 to be supported by the side end portion 20 of the first fixing metallic member 15. A condition wherein the end portion 19 of the resilient movable holding member 18 is put in passing through the supporting slit 21 provided on the side end portions 20 of the first fixing metallic member 15 in the longitudinal direction of the insulating housing 13 from the outside to the inside of the first fixing metallic member 15, is stably maintained with resiliency of the resilient movable holding member 18 by which both of the end portions 19 of the resilient movable holding member 18 are caused to move from the outside to the inside of the first fixing metallic member 15.

The supporting slit 21 is formed to elongate in a direction perpendicular to the longitudinal direction of the insulating housing 13 and thereby the end portion 19 of the resilient movable holding member 18, which is put in passing through the supporting slit 21 in the longitudinal direction of the insulating housing 13 from the outside to the inside of the first fixing metallic member 15 to be supported by the first fixing metallic member 15, is movable along the supporting slit 21 in the direction perpendicular to the longitudinal direction of the insulating housing 13. As a result, the resilient movable holding member 18 on the whole is provided on the plug connector 11 to be movable in the direction perpendicular to the longitudinal direction of the insulating housing 13.

Further, each of side plate portions included respectively in a pair of end portions of the insulating housing 13 and placed in the inside of the side end portion 20 of the first fixing metallic member 15 to face to the same, is provided with a supporting portion 22 for supporting, together with the side end portion 20 of the first fixing metallic member 15, the end portion 19 of the resilient movable holding member 18 having passed through the supporting slit 21 provided on the side end portion 20 of the first fixing metallic member 15.

As shown in FIG. 2, a middle portion 23 between the end portions 19 of the resilient movable holding member 18 is put in contact with a flat portion 24 between the side end portions 20 of the first fixing metallic member 15 and thereby the resilient movable holding member 18 is prevented from rotating with a rotational axis passing through the end portions 19 of the resilient movable holding member 18 supported respectively by the side end portions 20 of the first fixing metallic member 15.

Each of FIGS. 3 and 4 shows a receptacle connector 31 which constitutes a second connector included in the embodiment of circuit board connecting device according to the present invention and a second circuit board 32 on which the receptacle connector 31 is provided and which is shown with imaginary lines (two-dot chain lines). Further, FIG. 5 is a schematic bottom view showing the receptacle connector 31 and the second circuit board 32 on which the receptacle connector 31 is provided. Hereinafter, a surface of the second circuit board 32 facing downward in FIG. 3 is referred to a lower surface of the second circuit board 32 and a surface of the second circuit board 32 facing upward in FIG. 3 is referred to an upper surface of the second circuit board 32.

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As shown in FIG. 3, the receptacle connector 31 is attached to the lower surface of the second circuit board 32. Then, as shown in FIGS. 3 to 5, the receptacle connector 31 has an insulating housing 34 made of insulator such as plastics or the like to constitute a second insulating housing. The insulating housing 34 is mounted on the lower surface of the second circuit board 32 to be fixed to the second circuit board 32.

A plurality of second contacts 35 are arranged on the insulating housing 34 in a longitudinal direction of the same to make a couple of parallel lines each elongating along the longitudinal direction of the insulating housing 34. Each of the second contacts 35 is made of resilient conductive plate material to be shaped into a bent stripe and provided, respectively at both end portions of the bent stripe, with a board connecting portion 35a to be connected with a circuit terminal (not shown in the drawings) provided on the lower surface of the second circuit board 32 and a contact-connecting portion 35b operative to come into contact with the first contact 14 provided in the plug connector 11.

Further, a second fixing metallic member 37 which is divided into a couple of parts positioned respectively at a pair of end portions 36 of the insulating housing 34 in the longitudinal direction of the same is attached to the insulating housing 34. A plurality of board joining portions 38 are provided on each of separated parts of the second fixing metallic member 37 to be joined to the lower surface of the second circuit board 32. The second fixing metallic member 37 is operative to fix the insulating housing 34 to the second circuit board 32 when the board joining portions 38 are joined to the lower surface of the second circuit board 32.

A side end portion 39 of each of the separated parts of the second fixing metallic member 37 is provided thereon with an engaging portion 40 with which the end portion 19 of the resilient movable holding member 18 provided on the plug connector 11 engages. The engaging portion 40 is constituted in the shape of a cut-out formed on each of separated portions of the second fixing metallic member 37, with which the end portion 19 of the resilient movable holding member 18 supported by the side end portion 21 of the first fixing metallic member 15 is caused to engage. When the end portion 19 of the resilient movable holding member 18 engages with the engaging portion 40, the end portion 19 of the resilient movable holding member 18 passes through the cut-out formed on the side end portion 39 of the second fixing metallic member 37 in the longitudinal direction of the insulating housing 34 from the outside to the inside of the second fixing metallic member 37. A condition wherein the end portion 19 of the resilient movable holding member 18 is put in passing through the engaging portion 40 provided on the side end portion 39 of each of the separated parts of the second fixing metallic member 37 in the longitudinal direction of the insulating housing 34 from the outside to the inside of the second fixing metallic member 37, is stably maintained with resiliency of the resilient movable holding member 18 by which both of the end portions 19 of the resilient movable holding member 18 are caused to move from the outside to the inside of the second fixing metallic member 37.

The cut-out constituting the engaging portion 40 is formed to elongate in the direction perpendicular to the longitudinal direction of the insulating housing 34 and therefore the end portion 19 of the resilient movable holding member 18 having passed through the engaging portion 40 in the longitudinal direction of the insulating housing 34 from the outside to the inside of the second fixing metallic member 37 is movable along the cut-out in the direction perpendicular to the longitudinal direction of the insulating housing 34. As a result, the resilient movable holding member 18 on the whole is pro-

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vided on the plug connector 11 to be movable in the direction perpendicular to the longitudinal direction of the insulating housing 34.

Incidentally, it is possible for the engaging portion 40 provided on the side end portion 39 of each of the separated parts of the second fixing metallic member 37 to be constituted in the shape of a slit elongating in the direction perpendicular to the longitudinal direction of the insulating housing 34 in place of the cut-out.

Under such a condition, when the lower surface of the second circuit board 32 on which the insulating housing 34 of the receptacle connector 31 is mounted is caused to face to the upper surface of the first circuit board 12 on which the insulating housing 13 of the plug connector 11 is mounted and then the second circuit board 32 is closely laid on top of the first circuit board 12, the plug connector 11 and the receptacle connector 31 constituting respectively the first and second connectors included in the embodiment of circuit board connecting device according to the present invention are put in mutual engagement wherein the insulating housing 34 of the receptacle connector 31 is coupled with the insulating housing 13 of the plug connector 11.

On that occasion, first, as shown in FIG. 6 in which the second circuit board 32 is shown with imaginary lines, the receptacle connector 31 accompanied with the second circuit board 32 is positioned to be opposite to the plug connector 11 accompanied with the first circuit board 12 so that the insulating housing 34 of the receptacle connector 31 is caused to face to the insulating housing 13 of the plug connector 11 in such a manner that the longitudinal direction of the insulating housing 34 is in parallel with the longitudinal direction of the insulating housing 13 and the second contacts 35 arranged on the insulating housing 34 are positioned to correspond respectively to the first contacts 14 arranged on the insulating housing 13.

Next, when the second circuit board 32 is so positioned that the lower surface of the second circuit board 32 on which the insulating housing 34 of the receptacle connector 31 is mounted is opposite to the upper surface of the first circuit board 12 on which the insulating housing 13 of the plug connector 11 is mounted and then closely laid on top of the first circuit board 12, the insulating housing 34 of the receptacle connector 31 is coupled with the insulating housing 13 of the plug connector 11 in such a manner that the longitudinal direction of the insulating housing 34 is in parallel with the longitudinal direction of the insulating housing 13 and thereby the receptacle connector 31 accompanied with the second circuit board 32 and the plug connector 11 accompanied with the first circuit board 12 are put in mutual engagement, as shown in FIG. 7, FIG. 8 in which the second circuit board 32 is shown with imaginary lines, FIG. 9 in which the second circuit board 32 is omitted to be shown, and FIG. 10.

Under a condition wherein the receptacle connector 31 and the plug connector 11 are put in mutual engagement, as shown in FIG. 11 showing a cross-section taken along line XI-XI in FIG. 10, the contact-connecting portion 35b of each of the second contacts 35 arranged on the insulating housing 34 of the receptacle connector 31 is caused to come into contact with the contact-connecting portion 14b of a corresponding one of the first contacts 14 arranged on the insulating housing 13 of the plug connector 11. Thereby, each of the circuit terminals provided on the lower surface of the second circuit board 32, with which the board connecting portion 35a of the second contact 35 is connected, is linked through the second contact 35 and the first contact 14 to a corresponding one of the circuit terminals provided on the upper surface of the first circuit board 12, with which the board connecting portion 14a

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of the first contact 14 is connected, so that the first circuit board 12 and the second circuit board 32 are put in a condition of mutual electrical connection.

Further, as shown in FIG. 12 showing a cross-section taken along line XII-XII in FIG. 9 and FIG. 13 showing an inside of a tow-dot chain line frame B in FIG. 12, each of the end portions 19 of the resilient movable holding member 18 which has passed through the supporting slit 21 provided on the side end portion 20 of the first fixing metallic member 15 in the plug connector 11 in the longitudinal direction of the insulating housing 13 of the plug connector 11 from the outside to the inside of the first fixing metallic member 15 to be supported by the side end portion 20 of the first fixing metallic member 15 is caused to pass through the cut-out constituting the engaging portion 40 provided on the side end portion 39 of the second fixing metallic member 37 in the receptacle connector 31 in the longitudinal direction of the insulating housing 34 from the outside to the inside of the second fixing metallic member 37. That is, each of the end portions 19 of the resilient movable holding member 18 provided on the plug connector 11 is caused to engage with the engaging portion 40 formed on the side end portion 39 of the second fixing metallic member 37 in the receptacle connector 31, so that the insulating housing 34 of the receptacle connector 31 is held by the end portions 19 of the resilient movable holding member 18 supported respectively by the side end portions 20 of the first fixing metallic member 15 in the plug connector 11.

Each of the supporting slits 21 formed on each of the side end portions 20 of the first fixing metallic member 15 in the plug connector to elongate in the direction perpendicular to the longitudinal direction of the insulating housing 13 of the first fixing metallic member 15, is provided therein with first and second position-setting portions 21a and 21b arranged in the direction along which the supporting slit 21 elongates, as shown in FIG. 14 which shows an inside of a tow-dot chain line frame A in FIG. 8 and in which only one of the supporting slits 21 is shown. Then, each of the end portions 19 of the resilient movable holding member 18 having passed through the supporting slit 21 is put in engagement with the first position-setting portion 21a provided in the supporting slit 21 to be located thereby, as shown in FIG. 14, when the end portions 19 of the resilient movable holding member 18 engages with the engaging portion 40 formed on the side end portion 39 of the second fixing metallic member 37 in the receptacle connector 31.

The second position-setting portion 21b is operative to engage with the end portion 19 of the resilient movable holding member 18 having passed through the supporting slit 21 to locate the same when the end portion 19 of the resilient movable holding member 18 disengages from the engaging portion 40 formed on the side end portion 39 of the second fixing metallic member 37 in the receptacle connector 31 as described later.

Further, each of the end portions 36 of the insulating housing 34 of the receptacle connector 31 is provided thereon with a cam portion 41 having a slanting surface 41a to be positioned in the engaging portion 40 formed on the side end portion 39 of the second fixing metallic member 37 in the receptacle connector 31, as shown in FIG. 14 in which only one of the end portions 36 of the insulating housing 34 of the receptacle connector 31 is shown. The cam portion 41 is positioned also to correspond to a portion between the first and second position-setting portions 21a and 21b of the supporting slit 21 formed on the side end portions 20 of the first fixing metallic member 15 in the plug connector 11, as shown in FIG. 14.

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Each of the end portions 19 of the resilient movable holding member 18 comes into press-contact with the cam portion 41 when the end portions 19 of the resilient movable holding member 18 are caused to move in the direction perpendicular to the longitudinal direction of the insulating housing 13 of the first fixing metallic member 15 as described later. It is possible for the cam portion 41 to be not provided on each of the end portions 36 of the insulating housing 34 of the receptacle connector 31 but provided on each of the side end portions 39 of the second fixing metallic member 37 in the receptacle connector 31 to be positioned to correspond to the portion between the first and second position-setting portions 21a and 21b of the supporting slit 21 formed on the side end portions 20 of the first fixing metallic member 15 in the plug connector 11. The cam portion 41 thus provided on each of the side end portions 39 of the second fixing metallic member 37 in the receptacle connector 31 is made of metallic material and therefore prevented substantially from abrasion even if the end portion 19 of the resilient movable holding member 18 comes into press-contact repeatedly with the cam portion 41.

In such a manner as described above, the end portions 19 of the resilient movable holding member 18 provided on the plug connector 11 are caused to engage respectively with the engaging portions 40 formed respectively on the side end portions 39 of the second fixing metallic member 37 in the receptacle connector 31 for holding the insulating housing 34 of the receptacle connector 31 and thereby the insulating housing 34 of the receptacle connector 31 is effectively prevented from being separated undesirably from the insulating housing 13 of the plug connector 11.

The end portions 19 of the resilient movable holding member 18 supported respectively by the side end portions 20 of the first fixing metallic member 15 in the plug connector 11 and the engaging portions 40 formed respectively on the side end portions 39 of the second fixing metallic member 37 in the receptacle connector 31 constitute holding means included in the embodiment of circuit board connecting device according to the present invention, which is operative to hold the insulating housing 34 of the receptacle connector 31 for preventing the same from being undesirably separated from the insulating housing 13 of the plug connector 11 under the condition wherein the insulating housing 13 of the plug connector 11 and the insulating housing 34 of the receptacle connector 31 are coupled with each other.

Then, when the resilient movable holding member 18 provided on the plug connector 11 is moved in the direction perpendicular to the longitudinal direction of the insulating housing 13 of the plug connector 11, as shown with an arrow P in FIG. 15 in which the second circuit board 32 is omitted to be shown, under the condition wherein the insulating housing 34 of the receptacle connector 31 is coupled with the insulating housing 13 of the plug connector 11 so that the plug connector 11 accompanied with the first circuit board 12 and the receptacle connector accompanied with the second circuit board 32 are put in mutual engagement, the end portions 19 of the resilient movable holding member 18 each having passed through the supporting slit 21 formed on the side end portions 20 of the first fixing metallic member 15 in the plug connector 11 to be supported by the side end portions 20 of the first fixing metallic member 15 and put in engagement with the engaging portion 40 formed on the side end portions 39 of the second fixing metallic member 37 in the receptacle connector 31 are moved also in the direction perpendicular to the longitudinal direction of the insulating housing 13 of the plug connector 11.

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On that occasion, each of the end portions 19 of the resilient movable holding member 18 is moved along the supporting slit 21 elongating in the direction perpendicular to the longitudinal direction of the insulating housing 13 of the plug connector 11 within the engaging portion 40 and then comes into press-contact with the cam portion 41 provided on the end portion 36 of the insulating housing 34 of the receptacle connector 31 so as to shift further under guidance with the slanting surface 41a of the cam portion 41.

The slanting surface 41a of the cam portion 41 is operative to cause the end portions 19 of the resilient movable holding member 18 moving within the engaging portion 40 to shift resiliently in the longitudinal direction of the insulating housing 13 of the plug connector 11 to the outside of the side end portion 39 of the second fixing metallic member 37 in the receptacle connector 31. Thereby, each of the end portions 19 of the resilient movable holding member 18 disengages from the engaging portion 40 formed on the side end portions 39 of the second fixing metallic member 37 in the receptacle connector 31 when the end portions 19 of the resilient movable holding member 18 get respectively over the slanting surfaces 41a of the cam portions 41, as shown in FIGS. 16 and 17, and then ceases to move in the direction perpendicular to the longitudinal direction of the insulating housing 13 of the plug connector 11.

That is, when the resilient movable holding member 18 is moved in the direction perpendicular to the longitudinal direction of the insulating housing 13 of the plug connector 11 under the condition wherein the end portions 19 of the resilient movable holding member 18 is put in holding of the insulating housing 34 of the receptacle connector 31, each of the cam portions 41 provided on the end portion 36 of the insulating housing 34 of the receptacle connector 31 to be positioned in the engaging portion 40 formed on the side end portions 39 of the second fixing metallic member 37 in the receptacle connector 31 is operative to cause the end portions 19 of the resilient movable holding member 18 to shift resiliently for disengaging from the engaging portion 40.

Each of the end portions 19 of the resilient movable holding member 18 having disengaged from the engaging portion 40 formed on the side end portions 39 of the second fixing metallic member 37 in the receptacle connector 31 is put in engagement with the second position-setting portion 21b provided in the supporting slit 21 formed on the side end portions 20 of the first fixing metallic member 15 in the plug connector 11, as shown in FIG. 16. Thereby, the second position-setting portion 21b provided in the supporting slit 21 is operative to locate the end portion 19 of the resilient movable holding member 18 having disengaged from the engaging portion 40.

With the resilient shift to disengage from the engaging portion 40 formed on the side end portion 39 of the second fixing metallic member 37 in the receptacle connector 31, each of the end portions 19 of the resilient movable holding member 18 provided on the plug connector 11 causes the insulating housing 34 of the receptacle connector 31 to be released from holding by the end portions 19 of the resilient movable holding member 18. As a result, the insulating housing 34 of the receptacle connector 31 is able to be smoothly separated intentionally from the insulating housing 13 of the plug connector 11 so that the receptacle connector 31 and the plug connector 11 are released from the mutual engagement.

With the embodiment of circuit board connecting device including the plug connector 11 and the receptacle connector 31 as described above, when the insulating housing 34 of the receptacle connector 31 is coupled with the insulating housing 13 of the plug connector 11 so that the plug connector 11 accompanied with the first circuit board 12 and the receptacle

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connector 31 accompanied with the second circuit board 32 are put in mutual engagement and the second contacts 35 arranged on the insulating housing 34 of the receptacle connector 31 are put in contact respectively with the first contacts 14 arranged on the insulating housing 13 of the plug connector 11, the end portions 19 of the resilient movable holding member 18 provided on the plug connector 11 are caused to hold the insulating housing 34 of the receptacle connector 31 and thereby the insulating housing 34 of the receptacle connector 31 is prevented from being undesirably separated from the insulating housing 13 of the plug connector 11.

Then, when the resilient movable holding member 18 is moved in the direction perpendicular to the longitudinal direction of the insulating housing 13 of the plug connector 11 under the condition wherein the end portions 19 of the resilient movable holding member 18 is put in holding of the insulating housing 34 of the receptacle connector 31, the end portions 19 of the resilient movable holding member 18 are caused to release the insulating housing 34 from the holding by the end portions 19 of the resilient movable holding member 18. Thereby, the insulating housing 34 of the receptacle connector 31 is able to be intentionally separated from the insulating housing 13 of the plug connector 11.

The resilient movable holding member 18 provided on the plug connector 11 elongates along the longitudinal direction of the insulating housing 13 with the end portions 19 thereof supported respectively by the side end portions 20 of the first fixing metallic member 15 positioned respectively at the end portions 19 of the insulating housing 13 in its longitudinal direction to be movable in the direction perpendicular to the longitudinal direction of the insulating housing 13. The end portions 19 of the resilient movable holding member 18 supported respectively by the side end portions 20 of the first fixing metallic members 15 are caused to engage respectively with the engaging portions 40 formed on the side end portions 39 of the second fixing metallic member 37 in the receptacle connector 31 positioned respectively at the end portions 36 of the insulating housing 34 of the receptacle connector 31 in its longitudinal direction for holding the insulating housing 34 when the insulating housing 34 is coupled with the insulating housing 13. The condition of engagement wherein each of the end portions 19 of the resilient movable holding member 18 engages with the engaging portion 40 formed on the side end portions 39 of the second fixing metallic member 37 is maintained with resiliency of the resilient movable holding member 18 and thereby the insulating housing 34 is put in a stable holding by the end portions 19 of the resilient movable holding member 18.

Then, when the resilient movable holding member 18 is moved in the direction perpendicular to the longitudinal direction of the insulating housing 13 under the condition wherein the end portions 19 of the resilient movable holding member 18 are put in engagement with the engaging portions 40 formed on the side end portions 39 of the second fixing metallic member 37, each of the end portions 19 of the resilient movable holding member 18 is caused to disengage from the engaging portion 40 formed on the second fixing metallic member 37. As a result, the insulating housing 34 is released from the holding by the end portions 19 of the resilient movable holding member 18.

Accordingly, with the end portions 19 of the resilient movable holding member 18 provided on the plug connector 11 and the engaging portions 40 formed respectively on the side end portions 39 of the second fixing metallic member 37 in the receptacle connector 31, which constitute the holding means, the mutual coupling between the insulating housing 13 of the plug connector 11 and the insulating housing 34 of

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the receptacle connector **31** is stably and firmly maintained, and then the insulating housing **34** is able to be smoothly separated intentionally from the insulating housing **13** by quite simple and easy operations to move the resilient movable holding member **18** in the direction perpendicular to the longitudinal direction of the insulating housing **13**.

Further, with the resilient movable holding member **18** provided on the plug connector **11** to elongate along the longitudinal direction of the insulating housing **13** of the plug connector **11** and to have the end portions **19** thereof supported respectively by the side end portions **20** of the first fixing metallic member **15** in the plug connector **11** positioned respectively at the end portions **19** of the insulating housing **13** in its longitudinal direction to be movable in the direction perpendicular to the longitudinal direction of the insulating housing **13**, a thickness of the device including the plug connector **11** and the receptacle connector **31** put between the first circuit board **12** and the second circuit board **32** in a direction perpendicular to each of the upper surface of the first circuit board **12** on which the plug connector **11** is mounted and the lower surface of the second circuit board **32** on which the receptacle connector **31** is mounted, can be effectively reduced under the condition wherein the first circuit board **12** and the second circuit board **32** are put in the electrical piled-up connection.

The invention claimed is:

1. A circuit board connecting device comprising;

a first connector which has a first insulating housing, a plurality of first contacts arranged on the first insulating housing, each of which is provided with a board connecting portion to be connected with a circuit terminal provided on a first circuit board, and a first fixing metallic member attached to the first insulating housing for fixing the first insulating housing to the first circuit board;

a second connector which has a second insulating housing operative to be coupled with the first insulating housing, a plurality of second contacts arranged on the second insulating housing, each of which is provided with a board connecting portion to be connected with a circuit terminal provided on a second circuit board and is operative to come into contact with a corresponding one of the first contacts, and a second fixing metallic member attached to the second insulating housing for fixing the second insulating housing to the second circuit board; and

holding means operative to hold the second insulating housing for preventing the same from being undesirably separated from the first insulating housing under a condition wherein the first and second insulating housings are coupled with each other,

wherein a resilient movable holding member is provided on the first connector to elongate along a longitudinal direction of the first insulating housing with a pair of end portions thereof supported respectively by a couple of portions of the first fixing metallic member positioned respectively at a pair of end portions of the first insulating housing in its longitudinal direction and to be movable in a direction perpendicular to the longitudinal direction of the first insulating housing;

wherein a pair of engaging portions are formed respectively on a couple of portions of the second fixing metallic member positioned respectively at a pair of end portions of the second insulating housing in its longitudinal direction;

wherein the end portions of the resilient movable holding member supported by the first fixing metallic member

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are caused to engage respectively with the engaging portions formed on the second fixing metallic member for holding the second insulating housing when the second insulating housing is coupled with the first insulating housing, so that the end portions of the resilient movable holding member supported by the first fixing metallic member and the engaging portions formed on the second fixing metallic member constitute the holding means; and

wherein the end portions of the resilient movable holding member supported by the first fixing metallic member are caused to disengage respectively from the engaging portions formed on the second fixing metallic member for releasing the second insulating housing from holding by the holding means when the resilient movable holding member is moved in the direction perpendicular to the longitudinal direction of the first insulating housing under a condition wherein the second insulating housing is held by the holding means.

2. A circuit board connecting device according to claim 1, wherein each of the end portions of the first insulating housing in its longitudinal direction is provided thereon with a supporting portion for supporting, together with the portion of the first fixing metallic member, the end portion of the resilient movable holding member.

3. A circuit board connecting device according to claim 1, wherein each of the portions of the first fixing metallic member is provided thereon with a supporting slit through which the end portion of the resilient movable holding member passes to be supported by the portion of the first fixing metallic member so as to be movable in the direction perpendicular to the longitudinal direction of the first insulating housing.

4. A circuit board connecting device according to claim 1, wherein the resilient movable holding member is formed by bending a resilient metallic rod and each of the end portions of the resilient movable holding member supported respectively by the portions of the first fixing metallic member is movable resiliently in regard to the portion of the first fixing metallic member.

5. A circuit board connecting device according to claim 4, wherein each of the end portions of the second insulating housing in its longitudinal direction is provided hereon with a cam portion which is operative to come into contact with the end portion of the resilient movable holding member for moving the same resiliently to disengage from the engaging portion formed on the second fixing metallic member when the resilient movable holding member is moved in the direction perpendicular to the longitudinal direction of the first insulating housing under a condition wherein the end portions of the resilient movable holding member are put in holding of the second insulating housing.

6. A circuit board connecting device according to claim 4, wherein each of the portions of the second fixing metallic member is provided hereon with a cam portion which is operative to come into contact with the end portion of the resilient movable holding member for moving the same resiliently to disengage from the engaging portion formed on the second fixing metallic member when the resilient movable holding member is moved in the direction perpendicular to the longitudinal direction of the first insulating housing under a condition wherein the end portions of the resilient movable holding member are put in holding of the second insulating housing.

7. A circuit board connecting device according to claim 3, wherein each of the supporting slits is provided therein with a first position-setting portion for locating the end portion of the resilient movable holding member put in engagement

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with the engaging portion formed on the second fixing metallic member and a second position-setting portion for locating the end portion of the resilient movable holding member having disengaged from the engaging portion formed on the second fixing metallic member.

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8. A circuit board connecting device according to claim 1, wherein each of the engaging portions formed on the second fixing metallic member is constituted in the shape of a cut-out with which the end portion of the resilient movable holding member supported by the first fixing metallic member

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engages.

9. A circuit board connecting device according to claim 1, wherein each of the engaging portions formed on the second fixing metallic member is constituted in the shape of a slit with which the end portion of the resilient movable holding member supported by the first fixing metallic member

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engages.

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